

LM 28 & 29.

HW 8 #34 withdrawn.

will be in HW 9.

3/26/13

Quiz

Hydrogen 3 (tritium H-3) is sometime formed in the primary coolant water of a nuclear reactor. Tritium is a beta emitter (assume electron) w/ $t_{1/2} = 12.3$ yrs. For a given sample containing tritium after how many years will only about 12% of sample.

100 \rightarrow 50 \rightarrow 25 \rightarrow 12.5
3x half life.

$$\frac{\ln(2)}{k} = \text{Half life}$$

$$\ln\left(\frac{N}{N_0}\right) = -kt$$

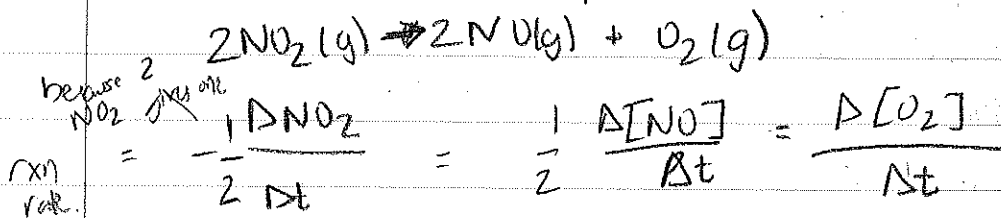
N = how much you have left.

~~N₀~~
N₀ = how much you started with.

$$\frac{\ln(2)}{12.3} = \frac{12.3 k}{12.3}$$

$$\frac{\ln(.12)}{-k} = \frac{-kt}{-k} \quad \boxed{t=37}$$

rxn rate - normalize it. \rightarrow permole



$$2 \text{mol NO}_2 = 1 \text{mol rxn.}$$

$$1 \text{mol O}_2 = 1 \text{mol rxn.}$$

divide by molar coefficient. to normalize rates.

$\Delta = \text{final} - \text{initial}$.

$$\text{Avg Rate} = \frac{[\text{NO}_2]_f - [\text{NO}_2]_i}{t_f - t_i} = \frac{\Delta[\text{NO}_2]}{\Delta t}$$

Instantaneous rate is slope of tangent line.

take derivative $-\frac{d[\text{NO}_2]}{dt}$

Initial reaction rate - is the rate at $t=0$. Best to define. determined by finding instantaneous rate @ $t=0$.



Macroscopic

$$\frac{-\Delta[\text{CH}_3\text{I}]}{\Delta t} = -\frac{d[\text{CH}_3\text{I}]}{dt} = \text{rate} = k[\text{CH}_3\text{I}]^1[\text{OH}^-]^1$$

1st order in CH_3I .
1st order in OH^-

Overall order = 2nd order rate kinetics.

* radioactive decay is always 1st order.



$$\frac{-\Delta[(\text{CH}_3)_3\text{CBr}]}{\Delta t} = -\frac{d[(\text{CH}_3)_3\text{CBr}]}{dt}$$

you need data to get 1st order or 2nd order.

exp. 1	0.1M	0.1M	} 2x (2.5 x 10 ⁻³ 5.0 x 10 ⁻³ 2.5 x 10 ⁻³)	Nothing changes.
2	0.2M	0.1M		
3	0.1M	0.2M		

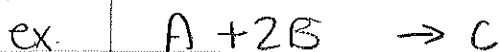
→ What is rate law for this reaction.

rate doesn't depend on OH^-

rate law tells me from data that 1st order for

$(\text{CH}_3)_3\text{CBr}$ & 0 order for OH^-

$$k[(\text{CH}_3)_3\text{CBr}]$$



The reaction is what order in B

exp.	A	B	initial rate
1	0.1 M	0.1 M	2.73
2	0.15 M	0.1 M	6.14
3	0.1 M	0.2 M	2.74

$A = 0$

looked at data from exp. 1 & 3, B concentration is change but rate is similar to 2.73.

ex. The reaction is what order in A?

$$\frac{6.14}{2.73} = \frac{k [0.15]^x [0.1]^y}{k [0.1]^x [0.1]^y}$$

$$2.245 = \left(\frac{0.15}{0.1}\right)^x \left(\frac{0.1}{0.1}\right)^y$$

$$2.245 = 1.5^x$$

$$\ln 2.245 = x \ln 1.5$$

$$x = 2$$

$$2.73 = k [A]^2 [B]^0$$

$$k [0.1]^2$$

$$2.73 = k \cdot 0.01$$

$$k = 273 \text{ M}^{-1} \text{ s}^{-1}$$

units for $k = \text{M}^{-1} \text{s}^{-1}$

Ex.



is rate = $k [\text{CO}]^2 [\text{H}_2\text{O}]$

Second order rate.

1st order in CO & 1st in H_2O .